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ASSIGNMENT BOOKLET
SCN3240 Chemistry 30
Module 4 Assignment

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Chemistry 30

Learn = veryWare

we explore

Batteries and Balance

Module 4

Assignment Booklet

Red Deer Catholic Regional Schools

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FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Lesson 2 Assignment		
Lesson 3 Assignment		
Lesson 5 Assignment		

Teacher's Comments

Chemistry 30 Learn EveryWare
Module 4: Batteries and Balance
Assignment Booklet
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Teachers	✓
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General Public	
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- Learning Resources Centre, **http://www.lrc.education.gov.ab.ca**
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Read all parts of each assignment carefully, and record your answers in the appropriate places. If you have difficulty with an assignment, review the relevant sections of the lesson and the textbook. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

MODULE 4: LESSON 2 ASSIGNMENT

Lesson 2 Assignment: Design of Commercial Cells

Part 1: Leaking Alkaline Dry Cell

Use a variety of resources (e.g., textbook, Materials Safety Data Sheets, Internet) to research how a leaking alkaline dry cell should be safely removed from an electronic device and disposed of. Prepare disposal instructions that you could provide to a family member. For each instruction, justify and explain the reasoning for the instruction as it relates to safety and exposure to chemical substances.

Part 2: Lab—Building Voltaic Cells

Pre-Lab

1. Complete the following tables to make predictions about the voltaic cells referenced. You will complete the row "Observed Cell Potential" while or after viewing the virtual investigation.

Cell 1	$Zn(s) \mid Zn^{2+}(aq) \parallel Cu^{2+}(aq) \mid Cu(s)$	Diagram of Operating Cell • direction of electron movement • direction of ion movement
Anode		
Cathode		
Reduction Half-Reaction		
Oxidation Half-Reaction		
Net Cell Reaction		
Predicted Standard Cell Potential		
Observed Cell Potential		
Spontaneous (Yes or No)		

Cell 2	$Zn(s) \mid Zn^{2+}(aq) \parallel Fe^{2+}(aq) \mid Fe(s)$	Diagram of Operating Cell • direction of electron movement • direction of ion movement
Anode		
Cathode		
Reduction Half-Reaction		
Oxidation Half-Reaction		
Net Cell Reaction		
Predicted Standard Cell Potential		
Observed Cell Potential		
Spontaneous (Yes or No)		

Cell 3	$Fe(s) \mid Fe^{2+}(aq) \parallel Cu^{2+}(aq) \mid Cu(s)$	Diagram of Operating Cell •direction of electron movement •direction of ion movement
Anode		
Cathode		
Reduction Half-Reaction		
Oxidation Half-Reaction		
Net Cell Reaction		
Predicted Standard Cell Potential		
Observed Cell Potential		
Spontaneous (Yes or No)		

Cell 4	$Mg(s) \mid Mg^{2+}(aq) \parallel Zn^{2+}(aq) \mid Zn(s)$	Diagram of Operating Cell • direction of electron movement • direction of ion movement
Anode		
Cathode		
Reduction Half-Reaction		
Oxidation Half-Reaction		
Net Cell Reaction		
Predicted Standard Cell Potential		
Observed Cell Potential		
Spontaneous (Yes or No)		

Cell 5	$Mg(s) \mid Mg^{2+}(aq) \parallel Fe^{2+}(aq) \mid Fe(s)$	Diagram of Operating Cell • direction of electron movement • direction of ion movement
Anode		
Cathode		
Reduction Half-Reaction		
Oxidation Half-Reaction		
Net Cell Reaction		
Predicted Standard Cell Potential		
Observed Cell Potential		
Spontaneous (Yes or No)		

Cell 6	Mg(s) | Mg^{2+}(aq) || Cu^{2+}(aq) | Cu(s)	Diagram of Operating Cell • direction of electron movement • direction of ion movement
Anode		
Cathode		
Reduction Half-Reaction		
Oxidation Half-Reaction		
Net Cell Reaction		
Predicted Standard Cell Potential		
Observed Cell Potential		
Spontaneous (Yes or No)		

2. In the data table above, record the observed cell potential for each of the cells constructed.

Analysis

3. Compare the predicted standard cell potentials with the observed values. Was there a discrepancy? Provide possible reasons for any differences.

4. Suggest a reason why very small voltaic cells were constructed for this investigation.

5. Would you expect a difference in the cell potential if larger cells had been constructed and tested? Suggest an aspect of a cell's function that may be affected by using a larger cell that contains a greater quantity of chemicals.

Part 3: Cell Potential

1. A Ni-Cd rechargeable cell has a cell potential of +1.30 V. If the cathode has a potential of +0.49 V, what is the anode's potential?

MODULE 4: LESSON 3 ASSIGNMENT

Lesson 3 Assignment: Electrolytic Cells

1. Explain, by making reference to scientific principles, why the same procedure can be used to analyze electric (voltaic) and electrolytic cells.

2. Consider the following cells:

   Cell 1: $Cu(s) \mid Ni(NO_3)^2(aq) \mid Cu(s)$
   Cell 2: $Ni(s) \mid HNO_3(aq) \mid Ni(s)$

   a. Identify which of the cells would produce a spontaneous reaction. Justify your answer using a detailed explanation that includes a cell potential and other supporting information for each of the two cells.

b. For each of the cells, identify one test you would use to confirm your prediction of spontaneity.

3. a. Use a potential energy diagram to describe the chemical change and the energy change in an electrolytic cell containing materials of your choice.

b. Describe how the minimum voltage for the cell you have described relates to the changes in potential energy shown on this diagram.

4. Complete "Practice" question 12 on page 645 of the textbook. For the first cell, identify tests you would use to confirm your predictions and your expected outcome for each test identified.

MODULE 4: LESSON 5 ASSIGNMENT

Lesson 5 Assignment: Quantitative Relationships in Cells

Use the following information to answer the questions.

Electroplating is a widely used process. One of the most popular electroplating processes involves the plating of two metals, nickel and chromium, in separate vats. Nickel is plated first because it adheres better to iron. Next, the object is moved to a second vat in which a layer of chromium is plated. Half-reactions occurring in each vat are shown below:

plating of nickel: $Ni^{2+}(aq) + 2\ e^- \rightarrow Ni(s)$

plating of chromium: $Cr_2O_7^{2-}(aq) + 14\ H^+(aq) + 12\ e^- \rightarrow 2\ Cr(s) + 7\ H_2O(l)$

1. The power supply used in commercial electroplating provides each vat with approximately 1.50×10^3 A of current for 20.0 minutes. In which vat is the greatest mass of metal deposited on a car bumper? Justify your answer.

2. To save on production costs, most automobile bumpers are never coated with more than 200 g of chromium. In order to plate 200 g of chromium, calculate the length of time for which a standard bumper should be immersed in a chromium vat.

3. Describe a strategy that can be used in electroplating to maintain the concentration of aqueous ion in the vat in which nickel is plated.

4. The following observations were collected during the virtual investigation "Electrolytic Cell" in Lesson 4:

Metal	Initial Mass (g)	Final Mass (g)	Change in Mass (g)	Qualitative Data
Carbon	9.76	9.87	0.11	The carbon rod was all black at the start of the experiment. At the end of the experiment, the section that was submerged in the solution of copper(II) ions had a bright reddish-brown precipitate on it.
Copper Electrode	12.07	11.96	0.11	The portion of the copper rod submerged in the solution appeared to be less lustrous than the portion that was not submerged.

Does the data demonstrate the expected stoichiometric relationships for this system? Use the data to justify your answer.

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